

## CLAIMS

What is claimed is:

1. A method of calculating the radiated sensitivity of a mobile terminal

comprising:

5 determining a reference sensitivity of the mobile terminal positioned in a  
reference orientation;

estimating an antenna gain of a mobile terminal antenna when the mobile  
terminal is positioned in a test orientation; and

adjusting the reference sensitivity based on the estimated antenna gain to  
10 calculate the sensitivity of the mobile terminal positioned in the test  
orientation.

2. The method of claim 1 wherein estimating the antenna gain of the mobile  
terminal antenna when the mobile terminal is positioned in the test orientation

15 comprises:

applying a known power level to the mobile terminal antenna when the mobile  
terminal is positioned in the test orientation; and

comparing the known antenna power level to a measured power level  
reported by the mobile terminal to estimate the antenna gain.

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3. The method of claim 2 wherein adjusting the reference sensitivity based on  
the estimated antenna gain to calculate the sensitivity of the mobile terminal  
positioned in the test orientation comprises calculating the sensitivity,  $S$ , of the mobile  
terminal according to:

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$$S = P_A - P_{meas} + S_r,$$

where  $P_A$  represents the known antenna power level,  $P_{meas}$  represents the measured power level,  $P_A - P_{meas}$  represents the estimated antenna gain, and  $S_r$  represents the reference sensitivity.

5     4.     The method of claim 1 further comprising determining a correction factor for each of a plurality of measured power levels reported by the mobile terminal.

5.     The method of claim 4 wherein determining the correction factor for each of the plurality of measured power levels comprises:

10         applying a plurality of known power levels to an input of a receiver of the mobile terminal; and  
             comparing each of the known power levels to a corresponding measured power level reported by the mobile terminal to determine the correction factor for each measured power level.

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6.     The method of claim 4 wherein determining the reference sensitivity of the mobile terminal positioned in the reference orientation further comprises applying the corresponding correction factor to the reference sensitivity to determine a corrected reference sensitivity.

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7.     The method of claim 4 wherein estimating the antenna gain of the mobile terminal antenna comprises:

             applying a known power level to the mobile terminal antenna when the mobile terminal is positioned in the test orientation;  
25         applying the corresponding correction factor to a measured power level reported by the mobile terminal to determine a corrected power level;  
             and

comparing the known antenna power level to the corrected power level to  
determine a corrected estimate of the antenna gain.

8. The method of claim 4 wherein adjusting the reference sensitivity based on  
5 the estimated antenna gain to calculate the sensitivity of the mobile terminal  
positioned in the test orientation comprises calculating the sensitivity,  $S$ , of the mobile  
terminal receiver according to:

$$S = P_A - P_{corr} + S_{corr},$$

where  $P_A$  represents the known antenna power level,  $P_{corr}$  represents the measured  
10 power level as corrected by the correction factor,  $P_A - P_{corr}$  represent the estimated  
antenna gain as corrected by the correction factor, and  $S_{corr}$  represents the  
reference sensitivity as corrected by the correction factor.

9. The method of claim 4 further comprising determining the correction factors  
15 for one or more frequency channels.

10. The method of claim 1 wherein determining the reference sensitivity of the  
mobile terminal positioned in the reference orientation comprises:

applying a known communication signal at one or more known antenna power  
20 levels to the mobile terminal antenna when the mobile terminal is  
positioned in the reference orientation;  
receiving a looped-back version of each communication signal and  
corresponding measured power level;  
calculating a signal quality of each looped-back version of the communication  
25 signal;

comparing each of the calculated signal qualities to a predefined signal  
quality; and  
identifying the reference sensitivity as the measured power level that  
generally corresponds to the predefined signal quality.

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11. The method of claim 10 wherein the signal quality is a bit error rate.

12. The method of claim 10 wherein the signal quality is a frame error rate.

10 13. The method of claim 1 further comprising adjusting the reference sensitivity  
based on the estimated antenna gain to calculate the sensitivity of the mobile  
terminal positioned in the test orientation for each combination of one or more  
frequency channels with one or more mobile terminal configurations.

15 14. The method of claim 13 wherein the one or more frequency channels  
comprise a high, a medium, and a low frequency in a frequency operating band of  
the mobile terminal.

15. The method of claim 13 wherein the one or more mobile terminal  
20 configurations comprise a free-space configuration, a left-ear configuration, and a  
right-ear configuration.

16. The method of claim 1 further comprising:  
estimating a second antenna gain when the mobile terminal is positioned in  
25 the second test orientation; and

adjusting the reference sensitivity based on the second estimated antenna  
gain to calculate a second sensitivity of the mobile terminal positioned  
in a second test orientation.

17. A computer readable medium to store a computer program for calculating a radiated sensitivity of a mobile terminal, the computer program comprising:

program instructions to determine a reference sensitivity of the mobile terminal positioned in a reference orientation;

5 program instructions to estimate an antenna gain of a mobile terminal antenna when the mobile terminal is positioned in a test orientation;

and

program instructions to adjust the reference sensitivity based on the estimated antenna gain to calculate the sensitivity of the mobile

10 terminal positioned in the test orientation.

18. The computer readable medium of claim 17 wherein the program instructions to estimate the antenna gain of the mobile terminal antenna when the mobile terminal is positioned in the test orientation comprises:

15 program instructions to apply a known power level to the mobile terminal antenna when the mobile terminal is positioned in the test orientation;

and

program instructions to compare the known antenna power level to a measured power level reported by the mobile terminal to estimate the

20 antenna gain.

19. The computer readable medium of claim 18 wherein the program instructions to adjust the reference sensitivity based on the estimated antenna gain to calculate the sensitivity of the mobile terminal positioned in the test orientation comprises

25 program instructions to calculate the sensitivity,  $S$ , of the mobile terminal according to:

$$S = P_A - P_{meas} + S_r,$$

where  $P_A$  represents the known antenna power level,  $P_{meas}$  represents the measured power level,  $P_A - P_{meas}$  represents the estimated antenna gain, and  $S_r$  represents the reference sensitivity.

5     20.     The computer readable medium of claim 17 further comprising program instructions to determine a correction factor for each of a plurality of measured power levels reported by the mobile terminal.

21.     The computer readable medium of claim 20 wherein the program instructions  
10     to determine the correction factor for each of the plurality of measured power levels comprises:

program instructions to apply a plurality of known power levels to an input of a receiver of the mobile terminal; and

15     program instructions to compare each of the known power levels to a corresponding measured power level reported by the mobile terminal to determine the correction factor for each measured power level.

22.     The computer readable medium of claim 20 wherein the program instructions to determine the reference sensitivity of the mobile terminal positioned in the  
20     reference orientation further comprises program instructions to apply the corresponding correction factor to the reference sensitivity to determine a corrected reference sensitivity.

23.     The computer readable medium of claim 20 wherein the program instructions  
25     to estimate the antenna gain of the mobile terminal antenna when the mobile terminal is positioned in the test orientation comprises:

program instructions to apply a known power level to the mobile terminal  
antenna when the mobile terminal is positioned in the test orientation;  
program instructions to apply the corresponding correction factor to a  
measured power level reported by the mobile terminal to determine a  
5 corrected power level; and  
program instructions to compare the known antenna power level to the  
corrected power level to determine a corrected estimate of the  
antenna gain.

10 24. The computer readable medium of claim 20 wherein the program instructions  
to adjust the reference sensitivity based on the estimated antenna gain to calculate  
the sensitivity of the mobile terminal positioned in the test orientation comprises  
program instructions to calculate the sensitivity,  $S$ , of the mobile terminal receiver  
according to:

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$$S = P_A - P_{corr} + S_{corr},$$

where  $P_A$  represents the known antenna power level,  $P_{corr}$  represents the measured  
power level as corrected by the correction factor,  $P_A - P_{corr}$  represent the estimated  
antenna gain as corrected by the correction factor, and  $S_{corr}$  represents the  
reference sensitivity as corrected by the correction factor.

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25. The computer readable medium of claim 20 further comprising program  
instructions to determine the correction factors for one or more frequency channels.

26. The computer readable medium of claim 17 wherein the program instructions  
25 to determine the reference sensitivity of the mobile terminal positioned in the  
reference orientation comprises:



program instructions to apply a known communication signal at one or more  
known antenna power levels to the mobile terminal antenna when the  
mobile terminal is positioned in the reference orientation;  
program instructions to receive a looped-back version of each communication  
5 signal and corresponding measured power level;  
program instructions to calculate a signal quality of each looped-back version  
of the communication signal;  
program instructions to compare each of the calculated signal qualities to a  
predefined signal quality; and  
10 program instructions to identify the reference sensitivity as the measured  
power level that generally corresponds to the predefined signal  
quality.

27. The computer readable medium of claim 17 further comprising program  
15 instructions to adjust the reference sensitivity based on the estimated antenna gain to  
calculate the sensitivity of the mobile terminal positioned in the test orientation for  
each combination of one or more frequency channels with one or more mobile  
terminal configurations.

20 28. The computer readable medium of claim 17 further comprising:  
program instructions to estimate a second antenna gain when the mobile  
terminal is positioned in a second test orientation; and  
program instructions to adjust the reference sensitivity based on the second  
estimated antenna gain to calculate a second sensitivity of the mobile  
25 terminal positioned in the second test orientation.

29. A test system for calculating a radiated sensitivity of a mobile terminal comprising:

a first interface;

a sensitivity test processor for configuring the test system in one of a plurality

5 of test modes;

wherein in a first test mode, the test system determines a reference sensitivity

of the mobile terminal positioned in a reference orientation via the first interface;

wherein in a second test mode, the test system estimates an antenna gain of

10 a mobile terminal antenna via the first interface when the mobile terminal is positioned in a test orientation; and

a sensitivity calculator for calculating the sensitivity of the mobile terminal positioned in the test orientation by adjusting the reference sensitivity based on the estimated antenna gain.

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30. The test system of claim 29 wherein in the second test mode, the sensitivity test processor configures the test system to:

apply a known power level to the mobile terminal antenna via the first interface when the mobile terminal is positioned in the test orientation;

20 and

compare the known antenna power level to a measured power level reported by the mobile terminal to estimate the antenna gain of the mobile terminal antenna when the mobile terminal is positioned in the test orientation.

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31. The test system of claim 29 further comprising a second interface, wherein in a third test mode, the test system determines a correction factor for each of a

plurality of measured power levels reported by the mobile terminal via the second interface.

32. The test system of claim 31 wherein in the third test mode, the sensitivity test  
5 processor configures the test system to:

apply a plurality of known power levels to an input of a receiver of the mobile  
terminal via the second interface; and  
compare each of the known power levels to a corresponding measured power  
level reported by the mobile terminal to determine the correction factor  
10 for each measured power level.

33. The test system of claim 31 further comprising a memory for storing each correction factor.

15 34. The test system of claim 31 wherein in the second test mode, the sensitivity test processor configures the test system to:

apply a known power level to the mobile terminal antenna via the first  
interface when the mobile terminal is positioned in the test orientation;  
apply the corresponding correction factor to a measured power level reported  
20 by the mobile terminal to determine a corrected power level; and  
compare the known antenna power level to the corrected power level to  
estimate the antenna gain of the mobile terminal antenna when the  
mobile terminal is positioned in the test orientation.

25 35. The test system of claim 31 wherein at least one of the first and third test modes comprise a characterization mode.

36. The test system of claim 31 wherein the second interface comprises a coaxial cable.
37. The test system of claim 29 wherein in the first test mode, the sensitivity test  
5 processor configures the system to:  
    apply a known communication signal at one or more known antenna power  
        levels to the mobile terminal antenna when the mobile terminal is  
        positioned in the reference orientation;  
    receive a looped-back version of each communication signal and  
10       corresponding measured power level;  
    calculate a signal quality of each looped-back version of the communication  
        signal;  
    compare each of the calculated signal qualities to a predefined signal quality;  
        and  
15       identify the reference sensitivity as the measured power level that generally  
        corresponds to the predefined signal quality.
38. The test system of claim 37 wherein the signal quality is a bit error rate.
- 20 39. The test system of claim 37 wherein the signal quality is a frame error rate.
40. The test system of claim 29 wherein the second test mode comprises a data  
collection mode.
- 25 41. The test system of claim 29 wherein the first interface comprises a test  
antenna.